MODELLING SUBSTRATE INHIBITION IN UASB SYSTEMS

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The present study represents a feasibility analysis of Haldane equation for modelling substrate inhibition in granules, the characteristic biomass structure in UASB reactors. However, the generalisation of the biokinetic parameters obtained with such models requires the separation of observed and true kinetic rates. Consequently, the possibilities of mass transfer limitations on the observed rates were also assessed analysing: a) the impact of the diffusion coefficient and diameter value on Weisz-Prater modulus, and b) substrate removal rate versus stirring velocity.

The Haldane equation, comprising a first order coefficient for the inhibition reaction, correlated the substrate removal rate and the volatile fatty acids (VFA) effluent concentration of an UASB continuous reactor. The inhibition constant (Ki) was 17296 mg/l and the substrate critical concentration (Sc) was 1760 mg/l, both expressed as COD. These values suggest that VFA have a limited toxic potential over the tested experimental conditions. On batch tests with a sacarose, VFA and phenol substrate, with a variable phenol concentration, to fit the data a generalisation of Haldane equation was required, considering the inhibition reaction order as an aditional degree of freedom. According to this assumption, it was possible to correlate the specific removal rate with the phenol concentration. The results obtained were n=1.7, Ki=3359 mg/l and Sc=390 mg/l as phenol-COD.

The Weisz-Prater modulus for the VFA assay, assuming an acetate difusivity of $0.148*10^{-4}$ m^2/day, gave a result higher than 1, for granules with 3 mm diameter. The degradation of sacarose and VFA with stirring was faster than without stirring. Consequently, the possibility of external and/or internal mass transfer limitations on the model's biokinetic constants should be taken into account.